FISH EATING HORSES IN CENTRAL MACEDONIA OF THE 5TH CENTURY BCE: WAS HERODOTUS FINALLY RIGHT?

Theodore G. Antikas
History Department, University of Washington, Washington State, USA

Summary. Five horses and two dogs buried in a human cemetery dating to the 4th-7th c. BCE were unearthed in 2003-5 during a rescue archaeology project at Sindos, southwest of Thessalonike, Greece. The good state of preservation of both human and animal skeletons due to the sandy alluvial deposits of the Rivers Axios and Haliakmon that cross the area was rare enough to prompt a detailed archaeozoological analysis. In addition to routine macroscopic and microscopic examination to determine sex, age, height, use and palaeopatholgy, carbon dating and multiple stable isotope analyses were performed by two independent laboratories: (a) the "Democritus" Nuclear Research Ctr. Archaeometry Unit, Athens; (b) the Carbon Data, FLA Both laboratories came up with identical data concerning stable isotope analyses which indicate that a portion of the horses' food was fish-related. The unexpected find is discussed in view of Herodotus's *Histories* in which he recorded the habit of ancient Macedonians to feed their pack horses with fish. Although more extensive sampling and research is needed to prove or disprove Herodotus, this find indicates that historians who referred to him as "father of lies" may need to reconsider their views.

Keywords: horse, stable isotopes, Greece.

5 AMŽIUJE PRIEŠ KRISTŲ VIDURIO MAKEDONIJOJE ARKLIAI MITO ŽUVIMI. AR HERODOTAS TIKRAI BUVO TEISUS?

Theodore G. Antikas
Vašingtono universitetas, Istorijos katedra, Sietlas, Vašingtono valstija, JAV

Santrauka. Penki arkliai ir du šunys palaidoti žmonių kapuose, datuojamuose 4–7 a. pr. Kr., 2003-2005 m. buvo iškasti Graikijoje, į pietvakarius nuo Thessalonike, įgyvendinant Sindos archeologinį projektą. Gerai išsilaikę abu žmogaus ir gyvūno skeletai rasti Axios ir Haliakmon upių santakos sąnašiniame sluoksnyje, kur archeozoologinė analizė atlikta skubotai. Atliekant įprastinius makroskopinius ir mikroskopinius tyrimus nustatyta arklio lytis, amžius, ūgis, paskirtis, paleopatologijos. Datavimas karbono ir sudėtiniais stabiliaisiais izotopais atliktas dviejose nepriklausomose laboratorijose: Archaeometrijos skyriuje, Branduolinių tyrimų centre „Democritus", Atėnuose, Radiokarbono datavimo laboratorijoje, Majamyje, Floridoje. Abi laboratorijos pasiūlė duomenis lyginti atliekant jų analizę stabiliaisiais izotopais. Vėliau nustatyta, kad didelę dalį arklių pašaro sudarė žuvys. Šis netikėtas atradimas aprašytas ir keliose Herodoto istorijose. Pasak Herodoto, senovės makedoniečiai, savo nešulinius arklius V a. pr. Kr. šėrė žuvimis. Nors surinkta nemažai duomenų ir atlikta tyrimų, sunku patvirtinti arba paneigti Herodoto pasakojimus, juolab kad istorikai jį vadino „melagių tėvu".

Raktažodžiai: arklys, stabilieji izotopai, Graikija.

®Fig. 1. **Sindos cemetery 700 to 300 BCE, 5 miles SW of Thessalonike**

Introduction. "*The houses of the <northern Greek> lake-dwellers are actually in the water … on platforms supported on...piles and approached from the land by a single narrow bridge… Each member of the tribe has his own hut…with a trap- door opening on to the water… Their horses and other pack animals they feed on fish, which are so abundant… that, when they open the trap-door and let down an empty bucket on a rope, they have only a minute to wait before they pull it up again, full. The fish are of two kinds…"* (Herodotus, *Historiae* 5.16).

The burial of nobles, heroes and Olympic victors with (their) horses was first documented in Homer's Iliad. That Mycenaean practice was to last for a long period of time as reported by later writers such as Herodotus and many others. Hundreds of such burials dating from the 16th to the 3rd century BCE have been found in tombs spreading from W. Thrace to the Peloponnese, in the last thirty years (Figs. 1-5), thus confirming the reports of ancient writers almost verbatim. On the other hand, the possibility of equines being carnivorous (or at least omnivorous), some time in their fifty-million-year evolution, was thought to be a myth and was discussed only scantily in the works of ancient writers, among which Eurypides and Pausanias. The latter do mention "man-eating" horses and mares,

which turn crazy until they are finally "tamed" (or domesticated?) by legendary heroes. Herodotus goes as far as to support the idea of fish eating horses as seen on the caption of this introductory note, and his phrase has caused skepticism to more than a few modern scholars, who claim that he made "gross overstatements" and add these in their armory aimed at discrediting him.

The existence of man-eating or fish eating horses in archaic times, whether it be true or false, is a legitimate hypothesis that could only be tested in a scientific multidisciplinary approach by archaeologists, archaeozoologists, geneticists, biologists and nuclear physicists. In this context, the Aristotelian University of Thessalonike; the 17th 16th and 4th, Ephorates of Classical Antiquities at Pella, Thessalonike and Nauplion, respectively); and the Nuclear Research Center "Democritos" in Athens adopted a five-year project proposed by the author, in 2003. The first extensive skeletal analyses for stable isotopes (oxygen, carbon, nitrogen) from bones and teeth of horses buried at Sindos (Fig. 6) took place in the period of 2003-2005. The results tend to confirm the existence of protein-eating horses in the past, just as Herodotus and other ancient authors mentioned above had claimed. The evidence obtained from the Sindos horse skeletons is the subject of the present paper.

®Fig 2. **Aidonia, 1973** (15th c. BCE horse)

®Fig 3. **Aigai, 1977** (4th c. BCE horse)

®Fig. 4. **Akanthos, 1992** (4th c. BCE horse)

®Fig 5. **Dendra, 2003** (15th c. BCE)

Materials and Methods

1. The Sindos Horses

The 47 humans, five horses and two dogs unearthed at Sindos date from the 7th to the 3rd century BCE. As the MNI of adult men was estimated to be 17, the high ratio of horses per man (1:3) suggests that Sindos may have been a city where cavalry men (*asthetairoi)* were recruited for the necessities of wars during the mid-4th century BCE (Philip's era). This because the maximum ratio found in other *necropoleis* in Macedonia was 1:200. In addition, Sindos lies between the rivers of Axios and Gallikos in Central Macedonia, near the lake area of Volvi (Fig. 6). In other words it could be the rich area Herodotus mentions in his passage in reference to King Darius' march through the plains of northern Greece in

the turn of the 5th century BCE. Horse bones and teeth were handled with gloves, cleaned with distilled water, photographed, X-rayed, packed in acid free and/or aluminum paper, and those in perfect condition were selected for radiocarbon and stable isotope analyses following standard techniques.

®Fig. 6. **The Polykastro horse burial, 7th c. BC**

2. Carbon and nitrogen stable isotopes
Carbon/nitrogen isotopes and diet

Carbon and nitrogen isotopic values from human and/or animal bone collagen are thought to reflect the diet, particularly that of dietary protein. Using such data, it is often possible to draw conclusions about:

- The levels of animal protein (meat and dairy products) in the diet, as compared to terrestrial plant consumption, i.e., the identification of omnivorous/ carnivorous dietary behavior.
- The consumption of plants following the $\mathbf{C_4}$ photosynthetic pathway (or protein from animals consuming such plants) compared to the consumption of $\mathbf{C_3}$ plants.
- The consumption of marine and freshwater dietary resources, in particular fish.

Values are averages of two replicates in separate batches using a "Europa Scientific Geo 20/20" isotope ratio mass spectrometer coupled to a "Roboprep" elemental analyzer. Controls analyzed were calibrated to international standards. The analytical precision is considered to be ± 0.2‰ for both $\delta^{13}C$ and $\delta^{15}N$. The collagen extraction employed ultra-filters, so that the collagen analyzed is that with a higher molecular weight. This is expected to remove contaminants and degraded collagen, but the process considerably reduces the yields for the samples. The quality indicators given in the table rely more on the *C:N ratio* and the element percentages than on the yield percentages. On this basis, the collagen is considered to be of appropriate quality to provide acceptable data.

Two independent laboratories were chosen to test the horse samples in a double blind protocol in order to avoid unnecessary sampling and preserve the anonymity of each sample and/or laboratory. Identical batches of bone and teeth samples were shipped to (a) the Stable Isotopes Laboratory at the University of Bradford and (b) the Archaeometry Lab at the Nuclear Research Center, Athens. Finally, the bone and teeth samples sent to both labs were given code numbers, i.e., Sin-1, 3, 4, 5 (horses), Sin-2 (dog), Sin-6 (cow).

Results
I. Archaeozoological Analyses
Horse # 1

® Fig. 7. **Sindos O.T-55. Horse # 1 in situ**

Stallion aged over 18 years and in poor conservation, probably due to the fact that it is the earliest burial dating to the 7th-6th century BCE. Carbon dating supported the initial, indirect dating based on a bronze bridle artifact probably made locally or at neighboring Pella. Under the horse's 4th lumbar vertebra (Fig. 7) small fragments of mandibles and teeth of *capra/ovis*, and of *sus scrofa* were found indicating that they were probably "leftovers" from a sacrifice or a funeral dinner, as there were signs of pyres around the tomb. As this stallion was the oldest among the five horses found at Sindos, and because carbon dating places him in the 7th-6th century, samples were taken for stable isotope analysis.

Horse # 2

® Fig. 8. **Sindos O.T-55. Horse # 2 in situ ®**

Adult mare aged over 15 years and belonging to a microsomatic type of autochthonous Greek horses, such

as the Skyros pony Her estimated height does not exceed 118 cm (12 hands). Pathological finds at the inter-phalangeal and tarsal joints (Figs 8-9) strongly indicate the use of this mare as a cart animal, which makes her not a very good candidate for stable isotope analysis.

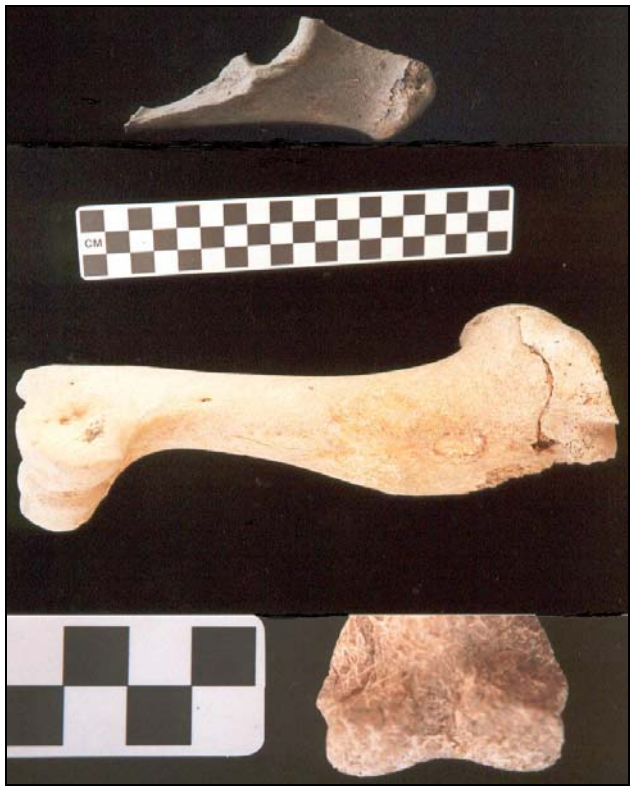
Fig. 9. **Visible ringbone and arthritis**

Horse #4

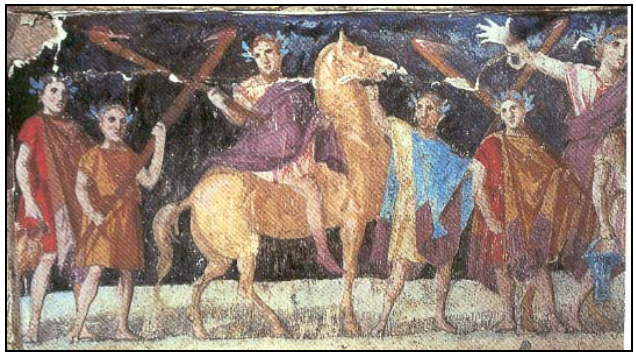
Aged 3-3.5 years, this was the youngest horse found at Sindos but its sex could not be determined. The age was calculated by the incomplete fusion of the epiphysis to the head of the *humerus* and/or the *olecranon*, processes (completed at the age of 4-41/2 years-Figs. 10-11). Other than the surprising young age of Horse #4, a very interesting detail concerning its burial site is the proximity to a young man's skeleton. As shown by arrows indicating the two graves on Fig. 1, the distance of ca. 55 cm, and the position of the horse across the dead man strongly suggest that the horse belonged to him.

®Fig 10. **Horse #4 surrounded by shells**

The man of T-34 was aged 20-25, and was buried with a wreath on his head, a *strigil*, a silver coin and a silver vase. Such finds are usually funeral offerings to cavalry officers and/or victors in equestrian events and have been documented by ancient historians such as Herodotus. Speaking of the burial of the Athenian Kimon, a triple victor in the *tethrippon* races at Olympia (536, 532, 528 BCE), Herodotus uses the term *'enanti'* (Gr: across) to describe the burial position of Kimon's mares in his tomb, just as in the case of T-34 and Horse #4 at Sindos. Hence it is logical to assume that T-34 may have been a cavalry officer and/or a successful *anabates* (rider). Finally, seashells accumulated to construct a surrounding wall may indicate a yet unknown cult practice, or simply a funeral dinner consisting of seafood, since Sindos is proximal to the delta of the Axios as it pours into the Thermaic Bay. The abundance of sea-derived food around this young horse and the postulate of its probable ownership by an affluent *hetairos* (companion) of the Macedonian cavalry were the reasons for sampling its bones for stable isotope analysis. Surprisingly, another find in a Macedonian tomb at Hagios Athanasios (a neighboring site to Sindos) where a rich *anabates* (rider) bearing a wreath and buried with horse tack across him bears a striking similarity to the T-34 and Horse-4 common burial at Sindos as shown on Fig 12.



®Fig 11. **Incomplete fusion of epiphyses**



®Fig 12. **Fresco from the tomb at Hagios Athanasios**

Horse #5 with Dog #2

®Fig 13. **Sindos Horse #5 and dog #2**

®Fig 14. **Coin of Alexander I, 5th c. BCE**

Adult mare aged 16±1 and measuring 140±2.5 cm at the withers. Her somatometrics indicate a phenotype of the native Thessalian horse breed to which Bucephalas belonged (Fig. 13). Pathological signs on her tarsal joints suggest a chariot or a *polemic* (war) horse. This hypothesis is substantiated by her size and the excellent state of preservation. These two parameters made her a candidate for stable isotope sampling. Seashells and burnt coccygeal vertebrae found proximally to her legs and in pyres next to the dog, strongly suggest a rich funeral dinner. Dog #2 buried close to her hind legs on the north-south axis was a young bitch aged 18-20 months, as indicate the dental attrition levels and the non-fusion of humeral heads. Her height was 30±2 cm, indicating a small type of hunting dog referred to as "Ghekas", whose provenance is north-northwestern Macedonia. Hunting dogs were often depicted on Greek coins (Fig 14), vases and frescoes. A most impressive scene is found on the fresco adorning the antechamber of the Royal Tomb II at Aigai where no less than nine dogs are shown hunting with Philip, Alexander and their companions (Fig 15).

Fig 15. **Artistic reproduction of the fresco on Royal Tomb II**

II. Radio-isotopic Analyses

Carbon-14 Dating

Bone and tooth samples of four horses coded for laboratory purposes as SIN-1, SIN-3, SIN-4 and SIN-5. Samples from Dog-2 and a cow were added for comparative purposes and coded as SIN-2 and SIN-6, respectively. Carbon dating placed *Horse-1* to the 6^{th}-7^{th} c. BCE, and *Horses 3, 4 and 5* to the 5^{th}, 4^{th} and 3^{rd} centuries BCE, respectively.

Stable Isotopes

Table I lists the results and Figure 19 depicts the same results in chart form.

The $\delta^{13}C$, $\delta^{15}N$ values coupled with the carbon-nitrogen ratios indicate that at least 18-22% of the horses' feed may have consisted of protein of fish origin. However more analyses are necessary to compare the equine data with those of herbivorous and/or omnivorous animals (*bovines, capra/ovis, canines, felines*) from the same time period and the same region, i.e., the Central Macedonian plains.

Some $\delta^{18}O$ values have also been obtained from both ancient and modern equines so as to establish water precipitation in the Sindos plain as opposed to mountainous areas in Central Macedonia some 2500 years ago. However the results are outside the scope of this paper.

Discussion and Conclusions

As Hesiod and Homer, Herodotus has also been criticized for including 'mythical' and 'exaggerated' realities in his *Histories*. Recent multidisciplinary studies by geneticists, archaeologists, archaeozoologists and physicists find elements of truth in more than a few of these exaggerations. As surprising Herodotus' statement on fish-eating horses may seem a less skeptical approach would lead scholars to consider it from a more scientific angle. Firstly, one has to wonder why at least three ancient sources mention man-eating or fish-eating equines. Secondly, the question as to why *E. caballus* a *perissodaktylon* (odd-fingered) like man has four sizable canine teeth if it where purely herbivorous, needs an answer. Last but not least, one has to consider whether Herodotus, an invitee at the Macedonian court, should refer to "*fish-eating horses and other pack animals"*

unless he witnessed or heard from locals that this was a fact. In another instance, Herodotus wondered why the lions at the River Axios *"ignored other living creatures and set only upon the camels-beasts never seen… before"*. Scholars have discredited the ancient historian by claiming there were no lions known to have existed in Macedonia. However, recent archaeological digs in Central Macedonia have unearthed skeletal elements of both lions and camels thus confirming both Herodotus and Xenophon, who went as far as to describe how lions were hunted at his time.

Table 1. **Stable isotope results for the Sindos fauna**

Sample Codes and Details	$\delta^{13}C$ (‰)	$\delta^{15}N$ (‰)	C:N	%C	%N	Yield (%)
SIN-1: horse long bone, tooth and rib samples (550mg)	-18.3	5.88	3.3	39.1	10.5	1.3
SIN-2: dog rib sample (481 mg)	-18.2	10.1	3.3	40.1	14.1	1.2
SIN-3: horse rib sample (433 mg)	-16.6	6.4	3.3	38.7	13.8	3.2
SIN-4: horse long bone sample (463 mg)	-22.0	5.4	3.4	34.8	12.0	1.3
SIN 5, horse rib sample (360 mg)	-18.0	5.9	3.5	30.1	10.1	0.7
SIN-6: bovid flat bone (556 mg)	-12.2	3.6	3.5	41.6	13.9	0.6

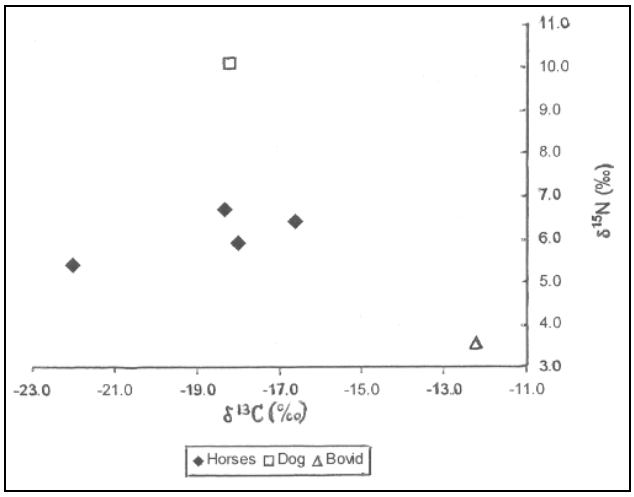


Fig 16. **$\delta^{13}C$ and $\delta^{15}N$ values for the Sindos fauna** (7^{th} to 3^{rd} century BCE)

The archaeozoological and stable isotope data re the Sindos horses tend to confirm there is truth in Herodotus' claims. A next step in the pursuit of truth would be to expand our study so as to include equines found in different regions of Greece (Thrace, Thessaly, Mycenae) dating to earlier periods, i.e., Minoan, Mycenaean, Iron and Classical Age. In addition, there is need for more control data obtained from purely herbivorous and omnivorous animals, so as the stable isotope values become comparable. Last but not least, an experimental protocol should test modern horses', mules' and donkeys' capacity to accept or reject eating animal protein feed(s) of meat or fish provenance. Unfortunately, recent developments in regard with BSE have impeded this phase of experimental research although our preliminary data on the palatability and acceptance of fish meat by horses supports the stable isotope finds.

In conclusion, Herodotus does not seem to have recorded myths or hearsays in speaking of *"fish-eating equines"* or *"camel-eating lions"* in the rich plains of Central Macedonia of the early 5^{th} century BCE. Just as Homer before him was not referring to a mythical Troy but to a real citadel, Herodotus was seemingly telling a story in his capacity as the father of history, but certainly not as the "father of lies".

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